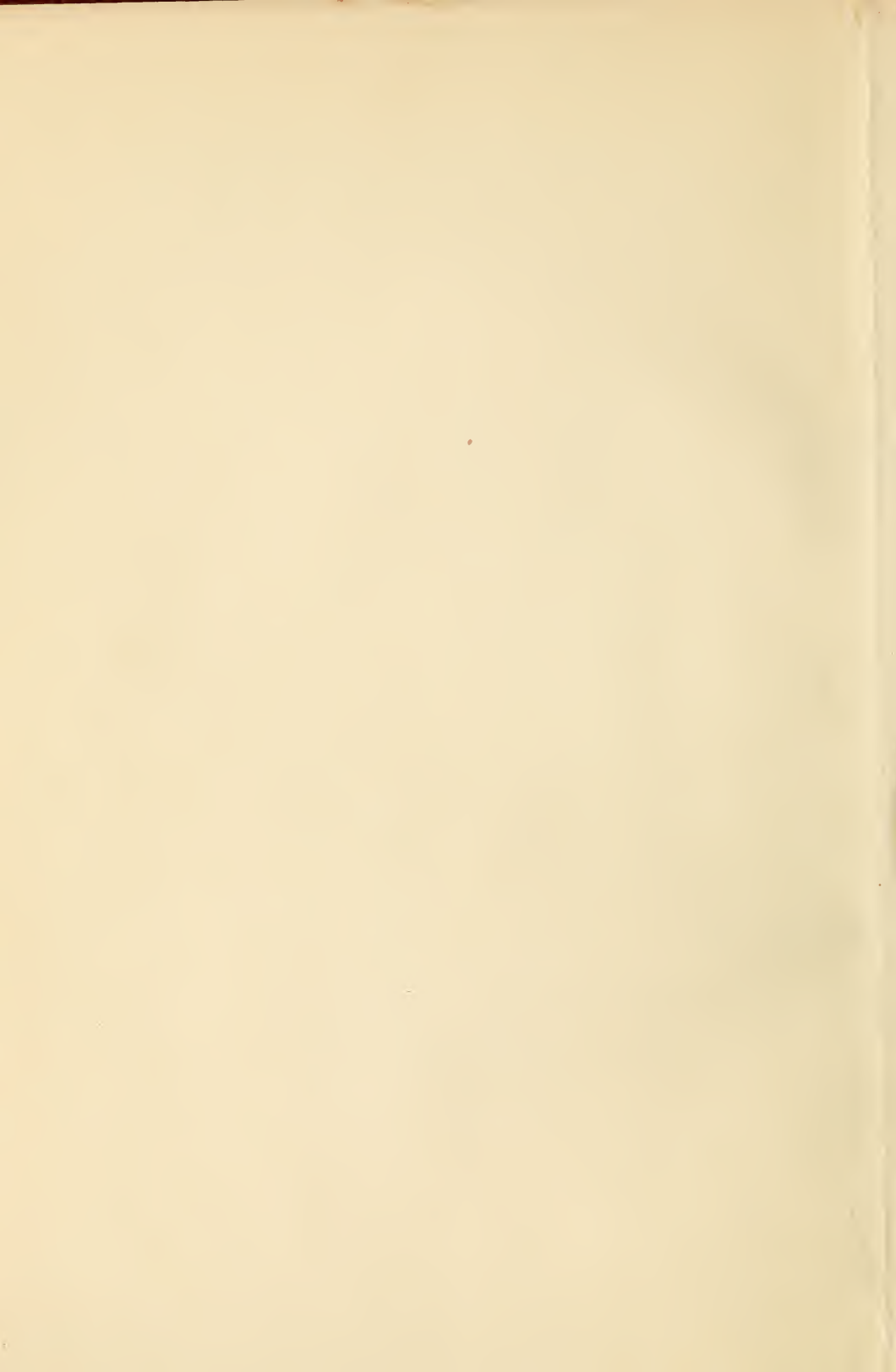


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U. S. DEPARTMENT OF AGRICULTURE
A HANDBOOK FOR

BETTER FEEDING OF LIVESTOCK

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BETTER FEEDING OF LIVESTOCK.

Great numbers of farmers have expressed to the United States Department of Agriculture their interest in problems of better feeding, growth, and development of livestock.

This handbook has been prepared by department feeding specialists for distribution to farmers who desire a handy-sized set of simple rules and reference tables to be followed in feeding the different classes of farm animals. It aims to aid farmers in understanding the principles of better feeding and in using the best practices which are adaptable to conditions on their farms.

No set of specific feeding rules can be wisely applied throughout the country. Local conditions, seasonal changes, and many other factors combine to make the best feeding practices change from place to place and from time to time. This handbook discusses the main points most commonly encountered in feeding, but which should always be adapted to local conditions. More general discussions of feeding practices will be found in Farmers' Bulletins and other publications of the department, also in publications of the State agricultural colleges and experiment stations.

J. R. MOHLER,
Chief, Bureau of Animal Industry.

HOW TO USE THIS HANDBOOK.

For general information consult Part I (pages 1 to 11), which deals with the chief everyday problems of livestock feeders.

For directions for feeding the different animals consult Part II (pages 11 to 35), using the index to find the kind in which you are interested.

For weight, measure, composition, and comparative values of feeds and explanation of feeding terms consult Part III (pages 36 to 42).

The index at the back of the handbook lists the entire contents in alphabetical order.

A HANDBOOK FOR BETTER FEEDING OF LIVESTOCK.†

Compiled by E. W. SHEETS and WILLIAM JACKSON, *Bureau of Animal Industry.*

PART I.—HELPS IN EVERDAY FEEDING PROBLEMS.

IMPORTANCE OF A GOOD CROPPING SYSTEM.

The advantages of a good cropping system for the farmer who is feeding several classes of livestock under average farm conditions can not be too greatly emphasized. Those crops that can be grown cheaply and well on his own farm usually constitute the most economical feeds that the livestock feeder can use. Furthermore, a carefully worked-out cropping system will provide for the maximum amount of good pasture, one of the greatest aids to successful feeding of livestock.

SELECTING ANIMALS FOR FEEDING.

The selection of good animals is important, whether they are to be fed for market or kept on the farm. The best feeders are strong, healthy animals of quiet disposition and good breeding. In cattle especially, and to some extent with other animals, feeding capacity is usually indicated by the appearance of the animal, as shown by general thriftiness, condition of hair, brightness of eye, width of muzzle, strength of jaw, and the capacity of the barrel or paunch. Good teeth are of utmost importance in good feeding animals.

Be sure that the animal is adapted to the purpose for which you are feeding it. Do not expect a dairy-bred animal to produce a choice beef carcass.

Purebreds of good quality do better in the feed lot than scrubs or common stock. A canvass of livestock feeders over the entire country shows that purebreds make about 40 per cent more product for their owners than scrubs or common stock when fed in the same way. Crossbred and high-grade stock make excellent feeders, owing to the good breeding of the purebred stock back of them.

ATTENTION TO DETAILS PAYS.

The wise stockman recognizes that careful attention to little details pays well in the end. The health and comfort of the

animals, their individual likes and temperaments, and many other things seemingly small, count for a great deal in successful feeding.

Rough treatment, excitement, and noise prevent the best results in feeding.

Other things being equal, the ration that is palatable is the one that will accomplish the best results; and yet many rations that are at first distasteful to animals may afterwards become highly palatable if the animal is given an opportunity to become accustomed to them.

Many animals like a little variation in the ration now and then. Sudden changes in feed are objectionable for all animals, but a little variation in the concentrate or roughage, or a change of pasture, will often be worth the trouble.

A successful feeder will carefully watch his animals, observe the comparative results of different rations and systems of feeding, and will learn much through experience and experimentation on his own farm.

SOME COMMON MISTAKES IN FEEDING.

Reports received by the United States Department of Agriculture from several hundred livestock feeders in all parts of the country mention mistakes commonly made in feeding livestock. According to the reports, the principal ones, in order of prominence, are:

Poor combinations of feed (forming improperly balanced ration).

Underfeeding.

Too little protein supplied in the ration.

Failure to supply animals with sufficient water.

Lack of legume pastures and hays.

Abrupt changes in feeding.

Poor housing for animals.

Feeding animals infested with lice, mites, and other parasites.

Failure to give animals sufficient salt and other minerals.

Waste of feeds.

Poor feeding equipment, lack of self-feeders, etc.

Overfeeding.

Irregularity of feeding.

It will be seen that the proper compounding of rations is given first importance, also that underfeeding is a much more common error than overfeeding.

SPECIAL REQUIREMENTS OF ANIMALS.

Feeding experiments conducted in recent years have brought to light much new information regarding special requirements

of animals for certain food substances which may not be omitted from the ration without danger of serious harm to the animal. There has not been sufficient experimental work upon which to draw definite conclusions, but new information on the subject is being gradually acquired. Following is a brief summary of some of the special feed requirements as shown by the latest experiments:

PROTEIN MUST BE OF RIGHT KIND.

Growing animals not only require an abundant supply of protein, but the proteins must be of the right kind. Some proteins lack certain essential elements that may be supplied by other proteins. For example, experiments conducted at the Government experimental farm at Beltsville, Md., show that vegetable or plant proteins are not so valuable in an egg-laying ration for hens as animal proteins, such as meat scrap and fish scrap.

Until further studies have been made of the value of some proteins for supplementing others, a safe plan for livestock feeders to follow is to supply all the green pasture and succulence possible, and add as much variety to the ration as possible without making it too costly.

ABUNDANCE OF MINERAL MATTER IMPORTANT.

An abundance of minerals in the ration is of greatest importance in the case of young growing animals and females carrying young, but they are necessary for animals of all ages and conditions. Mineral matter not only makes up the skeleton of the animal, but it is found in all parts of the body.

Common salt, lime (calcium), phosphorus, and iodine are the minerals most commonly lacking.

Salt should be accessible to farm animals at all times, no matter what their ration.

Lime will often be deficient in the ration if it is made up principally of straw, roots, and the cereal grains and their by-products. Milk, skim milk, and buttermilk contain plenty of lime, while legume hays exceed all other farm-grown feeds in lime content. Lime in such a form as calcium phosphate or wood ashes (sifted to remove nails, etc.) may be added to the ration if it is thought lacking in lime.

Rations that contain sufficient protein usually contain plenty of phosphorus. Straws, beet pulp, potatoes, and molasses contain but little phosphorus. The cereals and their by-products are rich in this mineral. It can be supplied, if lacking, in the form of ground rock phosphate or ground bone, which also furnish lime.

LACK OF IODIN CAUSES GOITER.

In recent years in parts of the Northwestern States farmers have lost many new-born colts, calves, lambs, and pigs from a disease called goiter. In this disease the young are born weak or dead, and are often hairless, or have enlarged necks.

It has been found that this is caused by a lack of iodine in the ration of the dam, and the difficulty may be overcome by giving the pregnant dams potassium iodide in dilute form. Your local veterinarian, county agent, State agricultural college, or the United States Department of Agriculture should be consulted when special problems of this nature are confronted.

VITAMINS NECESSARY FOR GROWTH AND HEALTH.

Some of the recent feeding experiments with both human beings and animals have demonstrated that a ration to be satisfactory must contain certain compounds of unknown composition known as "vitamins." Lack of one or more of these vitamins may cause young animals to become stunted or may cause serious disease or death in both young and old animals.

For horses, cattle, and sheep, balanced rations, containing plenty of good roughage are rarely deficient in vitamins.

Hogs are likely to become unthrifty if they are confined and fed on grains with little other feed. Poultry often receive rations low in the necessary vitamins. Feeders of hogs and poultry should provide plenty of variety in the ration, green feed whenever possible, and supplement the ration with dairy products, meat or fish scrap, or other feeds containing animal proteins.

PREPARING FEED FOR LIVESTOCK.**GRINDING FEEDS.**

As a rule, it does not pay to grind, crush, or roll feed when the animals have good teeth and the grains are not small and unusually hard; but small, hard grains, like rye, wheat, barley, and kafir, should be ground or rolled.

Grains should be ground for very young lambs.

If the grinding is not too costly, it will often pay to grind grain for horses at very hard work, high-producing dairy cows, and fattening cattle when there are no hogs following them.

SOAKING AND COOKING FEEDS.

Soaking, steaming, or cooking feeds may slightly increase the digestibility, but usually not enough to pay for the expense and work involved. Cooking sometimes encourages animals to eat

more feed, and this is desirable when maximum gains are required.

Milk from tuberculous cattle should be boiled (to kill the germs) before being given to livestock, including poultry.

Potatoes should be cooked before being fed.

SHREDDING AND CUTTING ROUGHAGES.

Shredding fodder does not increase its feeding value, but it makes it easier to handle, and the cattle clean up shredded fodder more thoroughly than they do whole stalks. The refuse makes much better bedding than the whole stalks.

It rarely pays to cut or grind hay, except for horses doing very heavy work. If roughage is cut, it should not be made into a dusty meal.

• MEASURING THE FEED.

The careful feeder watches each animal and feeds according to the animal's needs. The safest way to do this properly is to have some way of measuring the feed.

If the feeder is using baled hay, or feed which has been weighed into sacks, it is easy to calculate how much is being given at each feeding. If using loose hay, the weight of an average forkful should be determined.

If feeding concentrates, the feeder can readily determine the weight of the contents of a measure. Weights and measures of the common feeds will be found on page 37.

UNDERFEEDING FARM ANIMALS.

Many farm animals are underfed and therefore can not produce a profit on the feed they consume. This is an unwise and costly practice, as is also that of omitting necessary nutrients from an otherwise plentiful ration. For instance, a cow capable of giving a heavy flow of milk is underfed even though she receives all the ear corn and corn fodder that she could eat. Proper rations are given later.

The danger of underfeeding is greatest when wintering young, growing stock. They should always be kept growing during the winter.

OVERFEEDING FARM ANIMALS.

Overfeeding is wasteful in several ways. Animals overfed may eat more than they need or can digest properly, and they may leave feed in their troughs which they will not eat later. They also may become sick and lose weight or go "off feed" for several days.

Old animals are more likely to be overfed than young ones. It is usually best to keep animals ready for a little more feed than they have been given.

NUMBER OF FEEDS PER DAY.

Horses at hard work and dairy cows producing heavily should be fed three times a day. Young animals should be fed at least three times a day, and the intervals between feeds should be as nearly even as possible. Two feeds a day for other animals is usually sufficient.

REGULARITY OF FEEDING.

A little attention to details in feeding and caring for animals sometimes counts for a great deal. Regularity of feeding usually repays the feeder for the added trouble.

RATION SHOULD NOT BE CHANGED ABRUPTLY.

Sudden changes in a ration are likely to throw an animal off feed. Although changes are often desirable or necessary, the new feeds should be started a little at a time. In like manner, when some feed is to be omitted from the ration, make the change gradually.

TO REDUCE DANGER OF BLOATING.

To reduce danger of bloating, cattle and sheep should be given a good fill of dry feed, particularly roughage, before they are turned on green forage, such as red clover or alfalfa, for any length of time. If some dry roughage is convenient for them in the pasture they often correct, of their own accord, tendencies to bloat.

Dew and rain increase the danger of bloating.

Horses and hogs are not subject to bloating, but before being turned out on green forage for any length of time they should be gradually accustomed to the change. Since much stock is lost from bloating, owners should investigate this subject fully, depending on the crop to be fed. The department will furnish information on request.

IMPORTANT TO SUPPLY PLENTY OF WATER.

Nothing can take the place of water. Be sure that it is clean and fresh and convenient to the animals. They may suffer from lack of water rather than go a long way for it, especially during very cold or very hot weather.

If horses, cattle, and sheep can get a good drink once or twice daily they will do well. Hogs and poultry should have water much oftener, preferably close at hand, where they can drink whenever they want it.

TONICS AND CONDITION POWDERS.

Healthy animals do not need tonics or condition powders. If a tonic is needed the feeder should examine his methods. Plenty of good feed, fresh water, exercise, sunshine, pure air, with sanitary surroundings, should keep an animal in good health. If a tonic is desired, one of known composition may be mixed at home. The following formulas are suggested for all stock except hogs. (A mineral mixture for hogs is given on p. 28.)

FORMULA NO. 1.		FORMULA NO. 2.	
	Pounds.		Pounds.
Glauber salt-----	2	Glauber salt-----	5
Soda-----	1	Saltpeter-----	1½
Salt-----	1	Fenugreek-----	1
Fenugreek-----	⅛	Gentian-----	2
Linseed meal-----	25	Linseed meal-----	50

For horses a heaping tablespoonful of one of these mixtures fed with the grain three times a day is sufficient.

EQUIPMENT FOR FEEDING.

Proper equipment, well arranged, saves feed and labor.

Grain and similar feeds should be kept in rat-and-mouse proof cribs or bins. These rodents eat large quantities and waste still more.

Labor-saving devices, such as self-feeders and racks, are economical.

Where large numbers of livestock are fed it is usually advisable to use a wagon or an overhead carrier from the feed room or bin to the feed troughs or bunks. Silage may be fed in the same way.

Chutes from the haymow into or near the mangers save labor.

THE USE OF SELF-FEEDERS.

The use of self-feeders is discussed in this handbook under feeding the different classes of animals. They are most useful in fattening hogs for market and in feeding chickens. They are great labor savers and are especially valuable when there is much farm work to do, for they can be filled at odd times and field work can go ahead with less interruption.

CREEPS FOR YOUNG ANIMALS.

All young, growing animals should be given additional feed in creeps or pens adjacent to the pens or pastures in which they are running with their dams. The creeps are so constructed that the old animals can not gain entrance to them. Size of opening should be regulated by both width and height.

HARVESTING CROPS WITH LIVESTOCK.

Crops may be harvested by livestock economically when the quantity trampled down and the injury to the soil does not exceed the cost of harvesting by hand. Harvesting by stock is most common with corn alone, or with corn and soy beans, cowpeas, or velvet beans. Poor stands of small grain, such as rye or barley, may also be harvested advantageously in this way. It is often good practice to harvest the best part of the crop before the stock is turned in.

Animals to be fattened by this method of feeding should be turned into the field first, and later replaced by other stock when the crop is about harvested, to clean up what the fattening stock has left. It is necessary to give livestock a good supply of water when crops are harvested in this way.

UTILIZING FARM WASTES.

Every livestock feeder should make a study of the conditions on his farm with the idea of feeding such products as are being wasted. Estimates show that more than \$100,000,000 worth of corn stover and straws are burned, plowed under, allowed to rot in stacks, or in other ways wasted in the United States, annually. Great quantities of inferior hay, grain, and roughage for which there is no ready market may be fed, with advantage, to livestock.

Cottonseed meal is often used as a direct fertilizer in sections where it is cheap. It will usually be much more profitable to feed it to some kinds of livestock, as discussed later, and apply the manure on the land. Very little of the fertilizing value in cottonseed meal is lost through feeding.

Crops usually grown for human use, such as potatoes and peanuts, may be so plentiful and cheap as to warrant feeding the surplus to farm animals instead of placing it in storage.

The wise feeder soon learns that the proper use of all farm by-products, waste, and surplus crops for livestock feed often constitutes the main difference between profit and loss in feeding.

DANGER IN FEEDING DEAD ANIMALS TO LIVESTOCK.

Feeding the carcasses of animals that have died of disease is a common source of infection to healthy stock. Experimenta-

tion has proved that healthy hogs may contract tuberculosis by eating chickens that died of the disease. The Bureau of Animal Industry investigated a case in which a large proportion of the hogs shipped from a certain ranch were found to be tuberculous when examined at the packing house. It was learned that practically all the poultry on the farm had the disease and that it had been the custom at this place to throw all dead hens into the hog yard, where they were greedily eaten.

The safest manner of disposing of carcasses of animals is to burn them to ashes; the next safest way is to cover them with lime and bury them deeply. If a carcass is left on the ground, birds, dogs, and other animals may feed on it and spread disease and parasites over a wide area.

FEEDING MILK FROM TUBERCULOUS CATTLE.

Milk from tuberculous cattle may spread the disease to any animals drinking the milk. It should never be fed without being heated at least to scalding temperature, or held at 145° F. for 30 minutes. To be certain of safety it is best, as a practical measure, to boil the milk.

IMPORTANCE OF KEEPING ANIMALS HEALTHY.

Animals even of the finest breeding, although given the best feeds in correct proportions, will not make a profit for the feeder if they are not properly cared for and kept in good health. Disease, lice, worms, and various discomforts are means of wasting feed. Feeders who can not understand the poor condition of their animals when given good feeds, should examine them carefully for ailments and remove the cause.

FEEDING EQUIPMENT SHOULD BE KEPT CLEAN.

Feeding equipment, especially when feeding young animals, should be kept clean. If the animals are given more feed in their boxes or troughs than they will clean up before the next feeding, this stale feed, if left, will be wasted and will also cause part of the new feed to be wasted.

Pails for feeding calves, bottles and rubber nipples for feeding orphans, and other feeding utensils, if allowed to become dirty, may often cause serious digestive troubles or permanent disease. Thorough cleaning and sterilization of the equipment will prevent this danger.

STOCK-POISONING PLANTS.

Plants which are injurious to domestic animals are found in all parts of the United States, but the heaviest losses by poisoning occur on the western ranges. Larkspur, whorled

milkweed, and loco weed are among the most destructive. Bulletins describing these plants and giving methods of treatment for poisoned animals may be obtained from the United States Department of Agriculture.

IMPORTANCE OF DEHORNING AND CASTRATING.

Cattle that are apt to be ill tempered may be more safely run with others of their kind, and will be much less dangerous to handle, if they are dehorned. Cattle also do better in the feed lot if the horns have been removed. It is better to prevent growth of horns when the animal is young than to dehorn later.

Males that are to be fattened should be castrated. They will be much quieter, fatten better, produce a better quality of meat, and bring a higher price when sold.

KEEPING FEEDING RECORDS.

Feeders of most classes of animals may profit by keeping feed and production records of their stock. Most successful dairymen keep a feed record and a milk record for each cow. This enables them to feed each cow to the limit of her milk-producing capacity and furnishes a good check on the efficiency of different rations and of different animals. Samples of convenient record blanks may be obtained from the various agricultural colleges or the United States Department of Agriculture.

COMMERCIAL FEEDS.

Most States require that each sack or package of commercial or concentrated feed, such as mill feeds and packing-house by-products, bear a tag giving some sort of analysis of the feed. Usually the per cent of crude protein, fat, and fiber is shown, and sometimes all the ingredients are given.

State officials who have charge of feed supervision publish bulletins and reports from time to time giving the State requirements for commercial feeds and the results of analyses of samples of the different feeds for sale within the State.

Livestock feeders should obtain copies of these bulletins and inform themselves concerning the best feeds to buy, and learn how to read and interpret feed tags.

Most farmers have in their farm-grown feeds an excess of fat and carbohydrates and a shortage of protein. Therefore the percentage of protein contained in a commercial concentrate is one good measure of its value. Commercial feeds of inferior quality usually contain a large percentage of crude fiber, which is of but little feeding value and therefore a very costly ingredient in a high-priced feed.

READY-MIXED FEEDS.

There are on the market a great many proprietary feeds which are aimed to furnish a ready-mixed, balanced feed for the different classes of animals. Many of these feeds are excellent and represent years of effort by the manufacturers to produce well-balanced and highly palatable feeds at reasonable prices. Others contain quantities of screenings, hulls, or other material of low feeding value. All such feeds should be bought with a guaranty as to the ingredients making up the mixture, or with a guaranty statement of the amounts of crude protein, fat, and fiber contained in them. Hogs, as a rule, should be given the various feeds separately and permitted to make their own choice.

WHEN SHOULD FEEDS BE MIXED AT HOME?

Farmers who are able to produce a variety of the proper feeds cheaply may save money by mixing their own feeds. But whether it will pay best to mix feeds at home or buy ready-mixed feeds will depend largely upon the value of farm grains plus the cost of grinding and mixing, as compared with the price of the commercial feeds plus the freight and hauling. Many city poultry feeders, for instance, find it cheaper and less troublesome to buy ready-mixed scratch grains and mash than to buy the grains and do their own mixing. It is often a good plan to try both home-mixed and ready-mixed feeds and observe the comparative results.

PART II.—DIRECTIONS FOR FEEDING VARIOUS CLASSES OF FARM ANIMALS.**FEEDING HORSES.**

In feeding horses the points that follow are a general guide, but the feeder should consider also their age, size, condition, and temperament. Two horses of about the same size and type often vary greatly in their feed requirements when doing the same work. A nervous disposition commonly accompanies the use of a large quantity of feed. If the work horse is underfed, it will lose body weight and energy and become weakened and liable to disease.

To furnish continuous energy for work, the horse must receive feed in excess of that needed for body maintenance. The amount of feed needed for maintenance is about two-thirds that needed by a horse at moderate work.

Oats is one of the best grains for horses, because of the hull, which furnishes sufficient bulk to prevent the horse from gorg-

ing. To prevent horses from eating oats too rapidly, a little chopped clover hay or some whole corncobs may be placed in the feed box with the oats.

Corn is also a good feed for horses. Wheat bran is very valuable for mixing with other feeds for idle horses and colts, because of its mild, laxative effect.

Even though not so nutritious as legume hays, timothy is the most popular roughage for horses, because it is usually free from dust.

Pasture is a valuable and appetizing feed for horses, whether idle or working. Alone it is not sufficient for horses at work, but should be supplemented with hay and a grain ration relatively high in protein.

Change the horse's feed occasionally, though not suddenly. A horse likes variety in his diet.

FEEDING LIGHT HORSES.

In horses of the light breeds that are used for driving, riding, or racing, the qualities for which they are fed include action, spirit, and endurance. Large, paunchy stomachs are therefore objectionable. The following points should be observed in feeding light horses:

They require proportionately more grain and less hay than work horses.

Oats easily rank first among the feeds for light horses; crushed or soaked barley and bran are good supplementary feeds.

Corn is too fattening to constitute the bulk of the grain ration for light horses.

A mixture of alfalfa (or clover), hay, and timothy will furnish a good roughage.

FEEDING WORK HORSES.

The quantity of feed for the work horse depends on the amount of work to be done and on the speed at which it is performed; a horse requires considerably more feed when working at a trot than at a walk. Following are general rules for average horses:

Allow $1\frac{1}{10}$ pounds of grain and $1\frac{1}{2}$ pounds of hay per 100 pounds of weight for a horse at moderate work.

Allow $1\frac{1}{2}$ pounds of grain and $1\frac{1}{4}$ pounds of hay per 100 pounds of weight for a horse at hard work.

As shown in the following rations, the kinds of grain and hay should govern the quantities used.

SUGGESTED DAILY RATIONS FOR HORSES.

Rations for 1,000-pound idle horse:

Ration No. 1:	Pounds.	Ration No. 2:	Pounds.
Ear corn-----	5	Cowpea hay-----	5
Alfalfa hay-----	3	Corn silage-----	5
Corn stover-----	9	Timothy hay-----	10

Rations for 1,000-pound horse at very light work:

Ration No. 3:	Pounds.	Ration No. 4:	Pounds.
Oats-----	8	Cowpeas (cracked)---	5
Alfalfa hay-----	4	Molasses-----	5
Timothy hay-----	6	Oat Straw-----	10

Rations for 1,000-pound horse at medium work:

Ration No. 5:	Pounds.	Ration No. 6:	Pounds.
Ear corn-----	13	Shelled corn-----	11
Alfalfa hay-----	6	Cowpea hay-----	6
Timothy hay-----	7	Corn stover-----	6

Rations for 1,000-pound horse at hard work:

Ration No. 7:	Pounds.	Ration No. 8:	Pounds.
Oats-----	12	Rolled barley-----	10
Bran-----	2	Gluten meal-----	2
Timothy hay-----	8	Alfalfa hay-----	8
Clover hay-----	5	Prairie hay-----	6

FEEDING SILAGE TO HORSES.

Silage may be fed to horses in limited quantities as a supplement to the regular ration. Good silage acts as an appetizer and a tonic, but it should not be fed in larger amounts than 10 pounds daily per animal. To feed moldy or frozen silage to horses is a dangerous practice.

WATERING HORSES.

Horses require about 10 or 12 gallons of water daily. If the horse has not had water for several hours and has been at hard work it should be watered before being fed. To allow a horse to drink too freely while warm is dangerous, but a small drink taken slowly will do no harm.

SALT FOR HORSES.

Horses should be given salt daily at about the rate of 1 ounce per head. Their great relish for salt will show their need for it. It is best to give salt separately from the feed.

CARE OF HORSES' TEETH.

Even the most careful feeding may leave the horse in poor condition if its teeth are not sound and even so as to permit proper chewing of the feed. Sometimes the first or milk teeth of young horses remain longer than they should, causing the permanent teeth to grow crooked. This should be watched for and the milk teeth removed with forceps.

FEEDING THE BROOD MARE.

If possible, brood mares should be kept working up to within about a week of foaling, but heavy work should be avoided as foaling time approaches. The following rules should be followed.

No dusty, moldy, or decayed feed should be given.

Feeds containing plenty of protein, lime, and phosphorus should be supplied.

Bran, linseed meal, or other laxative feeds should be added to the ration to keep the mare's digestive tract active.

A few days before foaling, the grain allowance should be decreased, and plenty of laxative feeds given.

A small feed of bran is good for the first meal after foaling, and the ration for several days should be light.

Within a week the mare may be turned on pasture, and at the end of two weeks put at light work.

FEEDING THE COLT.

The mare should be given plenty of pasture grass and grain to stimulate a plentiful supply of milk for the foal.

When from three to four weeks old the colt should be given some grain. A good mixture is 4 parts crushed corn, 3 parts bran, and 1 part linseed meal.

As soon as it will eat hay, provide some good legume hay.

Plenty of good fresh water should be given both the mare and foal.

Colts once stunted never fully recover. Always keep in mind that colts get more than half their full growth during the first year.

FEEDING THE ORPHAN COLT.

If the mare dies the foal may be raised on cow's milk if care is taken. The following points should be kept in mind:

Milk from a fresh cow whose milk is low in fat content is the best.

One tablespoonful of sugar and 3 to 5 tablespoonfuls of limewater should be added to each pint of milk.

The milk should be fed when warmed to blood heat. One-fourth of a pint should be given every hour for the first few days.

After that six, and later four, feedings a day will be sufficient, and the quantity of milk may be gradually increased.

Begin feeding grain and hay as soon as possible.

WEANING THE COLT.

The colt should be weaned at from 5 to 6 months old, when it is eating plenty of grain and hay. Separate completely from the mare. Having several foals together in the same lot keeps them more contented.

FEEDING THE STALLION.

Depending on the extent of service, the stallion should receive varying quantities of protein in the feed. Plenty of exercise is desirable. The best exercise for him is moderate work on the farm or on the road.

FEEDING MULES.

Mules should be given about the same quantities and kinds of feed as horses. There is no conclusive evidence to support the popular assertion that mules require less feed than horses for the same amount of work. Mules will often eat many feeds the horse will not touch, and they are less likely to overeat and founder. When shedding their milk teeth at 3 years of age mules should be fed carefully.

FEEDING BEEF CATTLE.

Pasture and roughages should be the foundation of beef-cattle feeding. Pasture is usually the cheapest feed.

Corn is the best fattening feed for cattle. They like it better than grain, and because of its carbohydrates and fats it produces a beef carcass of superior quality.

Corn contains too little protein, however, to be fed most economically without legume hay, or some concentrate rich in protein, such as cottonseed meal or linseed meal.

Silage is an excellent feed for all classes of beef cattle. Very little roughage is wasted when it is fed as silage.

In most sections the larger the proportion of silage in the ration of a fattening steer the more economical the gains.

The difference between the purchase price and the selling price of the animal is called the margin, and it is usually es-

timated on the basis of 100 pounds live weight. The principal factors affecting success in feeding cattle are:

1. The purchase price of the cattle.
2. Their weight when purchased.
3. The cost of each 100 pounds of gain.
4. The length of the feeding period.
5. The expense of buying and marketing the cattle.
6. The selling price.

While all six points are important, the feeder should give special attention to the third and fourth. He usually has more direct control over these than over the other factors.

FEEDING THE BEEF-BREEDING HERD.

The breeding herd should be kept on pasture as long as the pasture will maintain the cattle without becoming grazed too closely.

Where the pasture is not sufficient it should be supplemented with soiling crops, silage, or hay.

The cows should not be allowed to go undernourished in the fall or winter, and lose weight as is too often a practice, because they will not be strong enough in the spring to raise their calves properly.

Silage and legume hay make a good combination for winter feeding.

If legume hay is not available some protein-rich concentrate, such as cottonseed meal or linseed meal, should be given.

Cows suckling calves require more feed than dry cows.

FEEDING BEEF BULLS.

Beef bulls either should be fed well on protein-rich feeds before the breeding season starts, or be given additional feed when turned out with the cows during the breeding season. For a 2,000-pound bull 20 pounds of silage, 20 pounds of legume hay, and 6 to 8 pounds of a grain mixture of corn, oats, bran, and some protein meal make a good daily ration.

FEEDING THE BEEF CALVES.

Young calves on good pasture with good milking dams do not require any feeding.

If they are kept in a barn they should have all the good legume hay they can eat after three weeks old and all the grain they will clean up twice daily.

A good grain mixture is three parts each by weight of corn, oats, and bran, and 1 part of linseed meal.

For the first two or three weeks the corn and oats should be ground.

Keep the troughs clean and do not feed stale or moldy feed.

Be sure calves have learned to eat some feeds that will keep them growing, before attempting to wean them.

If they are on pasture the grain should be fed in a creep, which the cows can not enter.

When weaning, take them away from the cows abruptly, if possible, keeping them where they can neither see nor hear the cows.

FEEDING YOUNG BEEF-BREEDING STOCK.

Heifers and young bulls intended for breeding should be kept growing winter and summer in order to reach their full development. If stunted while young the expense of development will be increased.

Calves and yearlings should gain from 50 to 75 pounds per head during the winter.

Two- and three-year olds should be fed so as not to lose weight; the amount of gain they should make depends on the time of year they are to be marketed.

FEEDING BABY BEEF.

Calves to be marketed as baby beeves should be from well-bred stock that is blocky and of excellent beef type and conformation.

The calves must be kept growing constantly and rapidly.

If their dams are not supplying milk enough they should be fed grain even when on good pasture.

Before weaning they should be eating grain readily, so that they will keep right on growing and fattening without interruption.

It requires feed with a larger percentage of concentrates and richer in protein to fatten calves than to fatten older cattle.

Spring calves weaned in the fall and kept in the feed lot should be ready to sell the following spring before flies and hot weather come. Do not try to use pasture for them in the spring.

Fall-born calves may be weaned in the spring after the grass is good. They should have been taught to eat grain during the winter and should continue on a full feed of grain while on pasture. Early in the fall, they should be sold off of grass or put in a lot and fattened more. Silage is then best to take the place of grass.

It they have been properly fed and cared for, baby beeves should be ready for market at from 12 to 18 months of age.

FEEDING STOCKERS.

Stockers are calves not sold as veal nor fattened as baby beef, but kept through from one to three winters before being fattened. Cheap summer pasture is essential to success in this line of feeding. Stockers make good use of cheap roughages also.

Stockers should be kept growing at the rate of from 250 to 300 pounds per year. They should gain fully 10 per cent in winter and more in summer. Stockers which gain in winter make the cheapest gains for the entire year.

FEEDING STEERS IN DRY LOT.

Mature steers fatten in 3 to 4 months, 2-year-olds in 5 to 7 months, yearlings in 8 to 10 months, and calves in 10 to 12 months.

Steers should be started on feed gradually, giving practically all roughage at first and gradually increasing the concentrates to the full ration to be fed. Take 15 to 30 days to get them on full feed.

Keep them a bit hungry. Do not let them eat too much or they will go off feed and stop gaining, and it will be difficult to get them back to normal.

As little noise, disturbance, and rough handling as possible are necessary for the greatest gains.

A steer's capacity for feed decreases as it gets fat. The proportion of concentrates must be increased and roughages reduced toward the end of the feeding period.

As molasses is especially palatable to cattle, it often pays to use it as an appetizer even though it is more expensive than corn as a fattening feed.

Other feeds such as oats, flax, and linseed meal are often used toward the last of the feeding period to put the steers in better condition for shipping. Other grains and all laxative feeds, including silage and legume hay, should be reduced at least half during the last two to three days before shipping. Some dry roughage, such as grass hay, should be fed.

FEEDING STEERS ON PASTURE.

Pasture gains are usually the cheapest.

It often pays to supplement the pasture with grain or some meal rich in protein. Even full feeding of corn may be practiced on pasture in summer to advantage.

In regions of heavy fall rains cattle should be marketed before such rains bring on a new growth of grass, which is watery and may cause the steers to lose in weight. Likewise

in regions where pasture or ranges become dry, the steers should be marketed before they start to lose.

FATTENING BEEF HEIFERS, COWS, AND BULLS.

Heifers, cows, and bulls should be fattened in much the same way as steers.

Cows are generally not so highly finished as steers and may be fattened more largely on roughages.

Bulls, especially young bulls, generally are castrated before being fattened. Otherwise they will be restless and not fatten well.

Bulls may be fed to advantage on sloppy feeds under close confinement, as it helps to soften them, with benefit to the quality of beef.

SHELTER FOR BEEF ANIMALS.

Experiments show that during winters of ordinary severity fattening beef animals do as well in open sheds with adjacent yards as in warm barns. Cattle are often fed with good results in open yards with no protection other than windbreaks.

WATER FOR BEEF ANIMALS.

Fattening cattle should be supplied with pure water at the rate of not less than 10 gallons per head per day for 2-year-old steers.

SALT FOR BEEF ANIMALS.

Beef animals require from one-third to 1 ounce of salt per head daily, depending on their feed. It is usually best to keep salt before them at all times, but it may be given at regular intervals, at least as often as twice a week.

HOGS FOLLOWING STEERS.

When fattening cattle are being fed corn, corn silage, and other feeds with whole grains, hogs should be run with them to consume the undigested grain in the droppings of the cattle. The hogs should have water in troughs separate from the water supplied the cattle.

SAMPLE RATIONS FOR FATTENING STEERS.

The best ration in most cases is the one that will make the greatest gains at the least cost. Generally speaking, the crops grown on the farm, or locally, form the most economical constituents of a ration. The proportion of concentrate to roughage in the ration, the source of the necessary protein to balance the corn or other fattening feed in the ration, and other prob-

lems will depend upon the locality and the relative prices of the different feeds. Following are samples of good rations for fattening steers. They show the great variation that may be made in the ration without unbalancing it or unduly increasing the cost.

Ration No. 1:	Pounds.	Ration No. 3:	Pounds.
Corn-----	16	Cottonseed meal-----	4
Legume hay-----	14	Corn silage-----	50
Ration No. 2:		Ration No. 4:	
Corn-----	18	Corn-----	14
Cottonseed meal-----	2	Linseed meal-----	2½
Legume hay-----	9	Legume hay-----	3½
		Corn silage-----	25

FEEDING DAIRY CATTLE.

The dairy cow usually reaches her highest production in late spring or early summer when she is on good pasture. She is then both comfortable and well fed. Feeders should imitate these ideal conditions as closely as possible throughout the year.

Pasture is the natural feed for dairy cows. Good pasture is succulent and palatable and rich in protein, minerals, and vitamins.

If the dairy cow falls off in her flow of milk for lack of proper feed, water, or care, it is difficult or impossible to bring her back to a full flow until she freshens again.

Succulent feeds are of even more importance in feeding dairy cows than for other farm animals. They are highly palatable and have a beneficial laxative action.

Succulent feeds must be used to supplement short or parched pastures in summer, and to take the place of pasture in winter, or the cows will fall off in production of milk.

Heavy-producing cows should receive grain even when the pasture is the best. They can not eat and digest pasture grass enough to reach maximum production.

Pasture should not be used too early in the spring. This harms the pasture for the rest of the season, and the watery grass causes the cows to fall off in production.

A cow giving a full flow of milk needs fully as much feed as a horse at hard work. She can not get sufficient nourishment to maintain her own body and produce milk at the same time from roughage alone.

COMPOUNDING A GRAIN MIXTURE FOR DAIRY COWS.

A degree of bulkiness in the grain mixture aids digestion. When heavy feeds (like corn meal) are used, some bulky ones (like bran) should be included to lighten the mixture.

The mixture should be palatable, eagerly eaten by the cow and neither too constipating nor too laxative. Cottonseed meal is constipating, and should not form more than one-third of the mixture. Linseed meal is laxative, and should not be fed in greater quantities than $1\frac{1}{2}$ pounds a day.

Make up the kind of mixture to fit the roughage available. With roughage entirely of the low-protein class the grain should contain from about 18 to 22 per cent protein, while with exclusively high-protein roughage the grain ration need contain only 13 to 16 per cent. (See tables classifying various grains and roughages, pp. 39 and 40.)

Select grains that will furnish the various constituents, especially protein, at the least cost, using home-grown grains if possible.

GRAIN MIXTURES FOR DAIRY COWS IN SUMMER.

In supplementing pasture with grain it is not necessary for the percentage of protein in the grain mixture to be as high as for winter feeding, because good pasture is an approximately balanced ration. The grain ration to be fed with grass should, therefore, have about the same proportion of protein to other nutrients as the grass has.

Mixtures good for supplementing pasture without other roughage.

Mixture No. 1.	Pounds.	Mixture No. 2.	Pounds.
Ground oats-----	100	Wheat bran-----	100
Wheat bran-----	100	Corn meal-----	100
Corn meal-----	50	Cottonseed meal-----	25

GRAIN MIXTURES FOR DAIRY COWS IN WINTER.

The following mixtures should be taken as suggestions, rather than as rations to be followed exactly. Using these mixtures as guides, the feeder of dairy cattle should work out a mixture that will be most economical under his conditions.

Mixtures to be fed with low-protein roughages, such as corn silage, corn stover, timothy, prairie or millet hay, cottonseed hulls, etc.:

Mixture No. 3:	Pounds.	Mixture No. 4:	Pounds.
Corn meal-----	100	Corn meal-----	200
Cottonseed meal-----	100	Cottonseed meal-----	150
Linseed meal (old process)-----	100	Gluten feed-----	100
Wheat bran-----	200	Wheat bran-----	100

Mixtures to be fed with high-protein roughages, such as legume hays:

Mixture No. 5:	Pounds.	Mixture No. 6:	Pounds.
Corn meal.....	400	Barley.....	300
Cottonseed meal.....	100	Cottonseed meal.....	100
Gluten feed.....	100	Alfalfa meal.....	100
Wheat bran.....	100	Wheat bran.....	100

Mixtures to be fed with combinations of low and high protein roughages:

Mixture No. 7:	Pounds.	Mixture No. 8:	Pounds.
Corn-and-cob meal....	200	Corn meal.....	100
Cottonseed meal.....	100	Cottonseed meal.....	100
		Ground oats.....	100
		Wheat bran.....	100

HOW MUCH ROUGHAGE TO FEED DAIRY COWS.

Dairy cows should be given all the roughage that they will clean up, many feeders feeding as much as 3 pounds of silage and 1 pound of dry roughage for every 100 pounds live weight.

FEEDING DAIRY COWS ACCORDING TO PRODUCTION.

The quantity of grain mixture, grain, or other concentrate that should be given the dairy cow depends on three things, as follows:

The quality and quantity of the roughages fed.

The capacity of the cow for producing milk.

The relative prices of roughages and concentrates.

All cows should not be fed alike, because they have different capacities for converting feed into milk. By increasing the feed of the highest-producing cows and carefully consulting the milk sheets on which each cow's daily production is recorded, the skillful feeder will soon find that some cows in the herd will respond to the increased allowance and return a profit on the additional feed given. On the other hand, there are cows that have a limited capacity for milk production and are very likely to be overfed. When corn and other concentrates are cheap as compared with hay and other roughages, they should be fed in larger quantities than when unusually high in price.

The following rules furnish a good guide for feeding grain or other concentrates (usually in the form of a grain mixture) to dairy cows, under most circumstances:

Feed a grain mixture in the proportion of 1 pound to each 3 to 4 pints or pounds of milk produced daily by the

cow; or 1 pound of grain mixture for every pound of butterfat that the cow produces during the week.

Feed all the cow will respond to in milk production. When she begins to put on flesh above normal weight, cut down the grain.

WATER FOR DAIRY COWS.

One hundred pounds of average milk contain about 87 pounds of water. The dairy cow's water supply, therefore, demands the dairyman's most careful attention. Cows giving milk drink about four times as much water as dry cows. High-producing cows sometimes drink from 200 to 300 pounds of water a day. The production of many good dairy cows is lessened because they do not get plenty of fresh, pure water. During winter dairy cows should be watered two or three times daily, unless water is kept before them at all times. The water should be at least 15 or 20 degrees above freezing, and should be supplied at the same temperature each day. A cow will not drink enough stale or impure water for maximum milk production.

SALT AND OTHER MINERALS FOR DAIRY COWS.

A dairy cow requires an ounce or more of salt a day, and should have all she needs, but she should not be forced to take more than she wants. It is best, therefore, to give only a small quantity in the feed, and to place rock salt in boxes in the yard or pasture where she can lick it at will.

Recent experiments seem to show that the demand for calcium and phosphorus by dairy cows in full flow of milk is so large that these minerals should be supplied in addition to the regular ration when the ration does not contain an abundance of green forage in summer and plenty of well-cured legume hay in winter.

Both calcium and phosphorus will be supplied in sufficient quantity by adding from 2 to 4 pounds of steamed bone meal or ground rock phosphate to each 100 pounds of grain mixture.

FEEDING DAIRY COWS BEFORE CALVING.

Many cows fed a liberal ration for four to six weeks before calving will easily pay for the additional feed through the increased flow of milk in the subsequent lactation period. Dairymen usually find it most profitable to give the cow a rest by drying her off for that length of time, even though she would continue to give milk up to the time of calving.

FEEDING THE DAIRY BULL.

The dairy bull in full service should receive about the same ration as the cow in milk. His ration should contain an ample amount of protein. When idle or in partial service less concentrates will be needed.

FEEDING YOUNG DAIRY STOCK.

The following rules furnish a good guide for the feeding of dairy calves and young dairy stock:

The calf's first few meals should be the colostrum—its mother's first milk—to start and regulate the movement of the bowels.

Everything about the calf should be scrupulously clean.

Calves should be fed sweet milk of a uniform temperature (about 90° F.), and they should always receive a little less than they desire.

Milk from infected cows or from a creamery should be pasteurized before it is fed.

All calves should be fed regularly, with equal intervals between feeds; very young calves should be fed three times a day.

First and second weeks.—For the first four days, whole milk from the dam should be fed. A 50-pound calf should receive about 8 pounds of milk a day; a 100-pound calf, 12 pounds a day.

After this time whole milk from any cow in the herd (preferably milk containing not more than 4 per cent butterfat) may be fed.

Third week.—At the beginning of the third week skim milk may be substituted at the rate of 1 pound a day. The total quantity of the daily ration may be increased by 2 to 4 pounds, but this should be done very gradually.

Fourth week.—During the fourth week the change to skim milk should be continued until by the end of the week only skim milk is fed. With especially vigorous calves the change to separated milk may be made about a week earlier.

Fifth week and thereafter.—The quantity of separated milk can be gradually increased until 18 to 20 pounds a day are given, taking care to cut down the quantity at once if the calf leaves some in the pail.

When the calf is 2 months old, sour milk, whether whole, skim, or buttermilk, may be fed without harmful results, provided the change from sweet milk is made gradually.

Feed other than milk.—When from 2 to 3 weeks old the calf will begin eating a little bright hay and grain. When it learns to eat them, as much hay and grain as it will clean up twice

daily should be given. A good grain mixture is 3 parts (by weight) cracked corn and 1 part wheat bran.

Pasture, if available, should be provided when the calf is from 3 to 4 months old.

A little silage of choice quality may be given after the calf is 2 months old. When 6 months old, not to exceed 8 to 10 pounds may be fed daily, with some dry roughage and grain.

The use of milk is usually discontinued at the age of 5 to 6 months.

Milk substitutes lack much of being as satisfactory as either whole or skim milk. Recipes for calf meals are given in *Farmers' Bulletin 1336, Feeding and Management of Dairy Calves and Young Dairy Stock.*

Scours always hinders the growth and development of the calf. Reduce the feed immediately at least half and look for the cause. It is commonly caused by irregular feeding, over-feeding, sudden change of feed, fermented feeds, feeding dirty or sour milk or milk from diseased cows, the use of dirty pails or feed boxes, or by damp and dirty quarters—conditions that the feeder should remedy.

FEEDING HOGS.

Neither growing nor fattening pigs do well on corn alone. It is lacking in mineral matter and protein, and the proteins are not of the proper kind to balance the hog's ration.

Corn should be supplemented with feeds like skim milk, buttermilk, tankage, fish meal, shorts or middlings, old-process oil meal, soybeans, or good pasture crops and rape. These supply proper proteins and minerals. In sections where corn is not available and such feeds as peanuts, barley, and sweet potatoes are fed, care should be taken to provide proper supplementary feeds.

Good pasture for growing pigs, brood sows, and all classes of hogs is so valuable that it often constitutes the difference between success and failure in the hog business.

Because they are fed largely on grains, because of their rapid growth, and because of the small pens in which they are usually fed, hogs usually require more additional minerals than horses, cattle, or sheep. Lack of minerals causes sows to produce unthrifty litters, and crippled pigs may also result.

Self-feeders are excellent for feeding fattening pigs. They save labor and therefore help make cheap gains.

The practice of harvesting corn or other grain crops with hogs (commonly called "hogging down") has been proved economical.

Cottonseed meal can not safely be fed to hogs; they may, however, follow steers that have been fed cottonseed meal.

FEEDING BROOD SOWS.

Feeding during pregnancy should be liberal, but not so heavy as when the pigs are being suckled. A very fat sow produces pigs low in vitality, and she will be clumsy with them. A thin sow, on the other hand, can not nourish an average litter of pigs properly.

During pregnancy the sow should receive feeds containing plenty of protein, mineral matter, and water. She should have comfortable quarters, be allowed plenty of room for exercise, and be kept free from lice and worms.

Her grain ration should be fed dry, and toward the close of the gestation period it may be advisable to feed some linseed meal or a small amount of ground flaxseed.

During the winter, root crops are excellent to take the place of pasture and furnish succulence.

For three or four days before farrowing the sow's feed should be reduced somewhat.

The sow should have no feed the first 24 hours after farrowing, but should be liberally supplied with warm water. Then a thin slop of bran and middlings may be given.

For three or four days the feeding should be light, and full feed should not be given for a week or 10 days.

If the pigs scour, the sow is being overfed. If this trouble appears, discontinue feeding the slop to the sow, and give a small quantity of oats, scattered thinly on the floor. Dissolve a piece of rock lime, slightly smaller than a baseball, in a gallon of water, drain the water off the slaked lime and give it to the sow to drink; also bathe the sow's udder and teats with the limewater. In addition give the pigs (on the tongue) 1 drop of formalin solution prepared by mixing 1 ounce of standard strength formalin and 1 pint of water. Also, the sow's teats may be washed once or twice daily with a solution of formalin prepared by adding 1 ounce of this mixture to a second pint of water.

FEEDING THE YOUNG PIGS.

The first opportunity to force growth of the young pigs comes when they are about 3 weeks old, when a creep should be provided in the sow's pen or pasture. Shelled corn should be provided in a trough or self-feeder. When the pigs are 5 or 6 weeks old middlings or shorts, tankage, or fish meal should be provided in a separate trough or feeder.

WEANING THE YOUNG PIGS.

The young pigs should be weaned when from 10 to 12 weeks old, depending on the conditions of the pigs and sow and

whether the sow is to raise two litters a year. It is important that the pigs be eating grain before being weaned.

Weaning should be complete. Do not return the pigs to the sow. Also do not change the ration of the pigs when weaning. If skim milk is available it may be added, but in limited quantities. Any abrupt change in the diet should be avoided.

Good pasture is always advisable for young pigs.

FEEDING BREEDING PIGS.

Pigs to be kept for breeding purposes should be fed with the whole object of making them stretch out and develop bone and muscle in place of fat. After young gilts have been bred they must be fed a ration heavy enough to grow the litter and properly finish their own growth.

FEEDING FATTENING PIGS.

After weaning, the pigs to be fattened are fed in two periods: (1) the growing period, from weaning until within six weeks to two months of the marketing date, and (2) the finishing period, from that time up to marketing.

The ration during the growing period is much the same as that given breeding stock, except that more grain should be allowed. Plenty of pasture should be available. In feeding grain on pasture more success has been had by giving an amount equal to 3 per cent of the body weight than feeding in smaller quantities.

Much more corn and less protein concentrates are fed during the finishing period. A good ration would contain 10 pounds of corn to 1 pound of tankage. The change in the ration must be gradual and the increase in feed not too rapid, in order to keep the pig from going off feed.

Pastures furnishing plenty of protein, such as alfalfa and clovers, are excellent at this time to keep the pigs' appetites keen.

SELF-FEEDERS FOR HOG FEEDING.

Self-feeders have been proved very valuable for feeding hogs for market. They have the following advantages:

Hogs consume feed more rapidly and make larger daily gains.

They reach a marketable size at an earlier date.

There is an actual saving in the amount of feed required to produce 100 pounds of gain.

The self-feeder saves labor in hog feeding.

Two methods are practical in using self-feeders for hogs. The grain and protein supplement may be mixed and fed from

the same hopper, or they may be fed separately, allowing the pig to choose for itself. The latter method is preferred. Experiments show that the pig usually balances its ration properly, eating relatively less of the high-protein feeds as it gains in weight. However, if the pigs do not appear to be eating the proper proportions of each feed, the feeds should be mixed for them.

Though sometimes used for sows suckling pigs, self-feeders ordinarily are not used for feeding breeding hogs, because the hogs are likely to become too fat.

FEEDING THE BOAR.

The boar should be given plenty of protein feeds during the breeding season; he should be fed some laxative feed, such as wheat bran, and should have the run of a quarter acre or more of pasture in connection with his paddock.

MINERAL MIXTURE FOR HOGS.

In order to make sure that the hogs have plenty of mineral matter, a mineral mixture such as the following should be kept before them at all times:

	Pounds.		Pounds.
Charcoal-----	75	Pulverized copperas-----	1
Raw rock phosphate-----	3	Glauber salt-----	6
Salt-----	6		
Ground limestone-----	6	Total-----	100
Flowers of sulphur-----	3		

FEEDING GARBAGE TO HOGS.

When properly managed, the feeding of garbage to hogs is a practical means of pork production. The following points should be kept in mind in feeding garbage:

The garbage should be collected frequently and be free from tin cans, soap, broken glass, and other undesirable or injurious articles.

Raw garbage is better than cooked garbage, because pigs fed raw garbage will reject portions distasteful to them. While cooking mixes the product, forming a uniform mass which may contain substances injurious to hogs.

Frozen garbage should be thawed before being fed.

Hogs to be fed garbage should be immunized against cholera, preferably by the double, or simultaneous, treatment. This is very important, because of the frequent presence of raw pork scraps which may carry the disease.

WATER FOR HOGS.

Hogs drink from 4 to 12 pounds of water daily per 100 pounds live weight. Many hog feeders make the mistake of providing too little water. When given cold water in cold winter weather hogs are also likely to drink too little; ice on top of the water in the trough is still another cause for the hogs going thirsty.

When the ration contains milk or slop, little additional water is needed, but it is best to provide it in a clean trough or automatic waterer at all times.

FEEDING SHEEP.

Gentle handling, regular feeding, and quiet are especially important in feeding or fattening sheep.

Silage or root crops in proper amounts are useful in keeping ewes in good condition during the winter.

The breeding flock in summer needs good pasture, shade, salt, and plenty of fresh water.

Frequent changes of grazing ground in most sections are necessary to insure freedom from stomach worms when pastures do not provide a wide range.

When fattening lambs raised on grass, they should be made accustomed to grain and silage gradually, to prevent scouring and other digestive troubles.

The practice of harvesting corn with fattening lambs or sheep is a good one. Some crop, such as soybeans or rape, should be grown in the corn.

At the time ewes are bred they should be gaining in weight. Placing the ewes on abundant pasture and adding a grain supplement for two or three weeks before breeding—a practice called “flushing”—tends to increase the proportion of twin lambs and thus increases the lamb crop.

Timothy hay is not good sheep feed; legume hays are excellent.

Only silage from well-matured corn should be used for sheep, and caution should be exercised to guard against feeding spoiled, frozen, or moldy silage.

FEEDING THE BREEDING EWES.

Before the start of the breeding season in the fall, all nonbreeding, poor-milking, and broken-mouthed ewes should be discarded from the flock.

Have the ewes gaining in weight when they are bred.

Stubble and stalk fields, fence strips in plowed fields, late pastures, green rye pastures in the late fall, and velvet beans

(in the South) will help carry the breeding flock through the fall and well into the winter.

Legume hays, straw, and cornstalks usually form the main part of economical winter feeding.

Silage and root crops are good feeds, but should not be used when the pasturage is soft and watery.

Heavy grain feeding just before lambing may cause udder trouble.

After lambing, ewes should be fed lightly at first, and put on full feed about the third or fourth day.

RATIONS FOR BREEDING EWES.

Each of the following rations contains approximately the quantity of the various nutrients required daily for ewes of from 120 to 145 pounds in weight:

Ration No. 1:	Pounds.	Ration No. 2:	Pounds.
Alfalfa or cowpea hay—	2	Oat straw —————	1
Corn silage—————	2	Corn silage—————	2
Shelled corn—————	$\frac{1}{2}$	Oil meal—————	$\frac{1}{4}$
		Shelled corn—————	$\frac{1}{2}$

FEEDING THE LAMBS.

Well-nourished lambs from well-fed ewes have few troubles, but following are some points to bear in mind:

Constipation is remedied by a teaspoonful of castor oil.

White scours can be cured by giving one-fourth ounce of cooking soda, 1 ounce of sulphate of magnesia, and a pinch of ginger in a small quantity of flaxseed tea. The flaxseed tea is made by dissolving 1 teaspoonful of ground flaxseed in 1 pint of hot water. This should be followed in about four hours with 2 ounces of raw linseed oil.

If lambs are sold at 3 to 5 months of age, they may run with their dams until that time. Lambs to be kept for breeding should be weaned at that age and put on fresh pastures where there is no danger of stomach worms.

The best method of weaning is to leave the lambs on the old pasture for three or four days and remove the ewes to a scanty pasture to check their milk flow.

When 10 to 16 days old the lambs should have access to a creep where they may get hay in a rack and grain in a trough so arranged that they can not get their feet in the feed. Pea-green alfalfa of the second or third cutting is one of the most relished feeds. Flaky, sweet bran ranks next.

Until the lambs are 5 to 6 weeks old all their feed should be coarsely ground or crushed.

Cleanliness is an important factor in keeping the lambs growing. Always feed in an empty, clean trough, and if it is dirty scrub it out with limewater.

PREVENTION OF STOMACH-WORM INJURY.

When grass pastures are to be used for a flock turned out when the lambs are 5 to 8 weeks old it is desirable to have sufficient divisions to allow frequent changes without returning the lambs to any ground previously grazed in the same season. Hillside pastures are generally freer from stomach-worm infection than bottom lands because of the tendency for the worm eggs to be carried down by rains. Moreover, the greater moisture in bottom lands favors development of the worms. Hill-sides are consequently safer and better pastures for lambs, though the pasture may be less luxuriant. Lambs that are 6 weeks old when sent to pasture, and that have received some grain, can withstand a considerable degree of infection by parasites.

RAISING LAMBS BY THE DRY-LOT METHOD.

Some breeders of purebred sheep practice a dry-lot method of raising lambs, mainly to avoid stomach-worm trouble. The lambs do not leave the sheds or yards until they are weaned, when they are put on clean, fresh pastures. In the meantime they are fed hay and grain, and their dams are returned from the pastures two or three times each day to allow the lambs to nurse.

Some breeders keep both ewes and lambs in dry lots, growing soiling crops near by to be fed to the ewes to keep them milking well.

RAISING LAMBS BY THE FORAGE-CROP METHOD.

The practice of grazing the flock on forage crops until the lambs are sold is becoming popular where lands are high in price and where stomach worms cause trouble. Under this plan the ewes and lambs are first grazed on fall-sown wheat or rye. The land is divided to avoid the necessity of keeping the flock longer than 10 days on the same ground. By the time the second lot of this crop is grazed down, spring-grown peas and oats can be ready and the fall-wheat land plowed and reseeded to another cereal, or to rape or soybeans, for later use. This plan produces a large amount of feed per acre.

FEEDING RAMS.

Beginning a month before the breeding season, rams should be given some extra grain. Two parts of oats and one of

bran, by bulk, form an excellent mixture. Oats alone are also very good. If the ram is thin the following mixture, by weight, is excellent: Corn, 5 parts; oats, 10 parts; bran, 3 parts; and linseed meal, 2 parts. Rams should be fed about the same amounts per 100 pounds weight as breeding ewes.

WATER FOR SHEEP.

Sheep frequently suffer for water. A sheep needs from 1 to 6 quarts of water daily, depending on the feed received, the weather, and the condition of pasture.

SALT FOR SHEEP.

Salt should be kept before sheep at all times. They will overeat it if supplied only at intervals.

FEEDING MILK GOATS.

Milk goats should be given about the same kinds of feeds given dairy cows. From six to eight goats can be kept on the amount of feed usually given one dairy cow. A ration that has been used successfully in the herd of the Bureau of Animal Industry at its experimental farm at Beltsville, Md., for does in milk during the winter season is as follows: 2 pounds of alfalfa or clover hay, $1\frac{1}{2}$ pounds of silage or turnips, and from 1 to 2 pounds of grain. The grain ration consisted of a mixture of 100 pounds corn, 100 pounds oats, 50 pounds bran, and 10 pounds linseed meal.

When the does are on pasture they may be given 1 to $1\frac{1}{2}$ pounds of grain per day, of the mixture mentioned, with the exception of the linseed meal.

FEEDING POULTRY.

FEEDING HENS FOR EGG PRODUCTION.

Well-balanced, palatable feeds are necessary to get good egg production. With good stock, the additional cost of a good ration is repaid many times by the extra eggs obtained. Following are some points to be observed:

Feed simple grain mixtures supplemented with meat scrap, fish scrap, or milk.

Supply green feed of some kind throughout the year.

Feed a scratch mixture of whole or cracked grains twice daily. Feed sparingly so that the hens will eat all they receive.

Feed a mash, either dry or wet, made of ground grains and meat scrap, properly balanced.

Supply more than one kind of grain.

Make the hens exercise for their feed.

Give a light feed of grain in the morning, only supplying what the hens will clean up in half an hour.

Always give a full feed late in the afternoon, especially in cold weather.

SOME EGG-LAYING RATIONS.

The following rations have been used with good results at the Government experimental farm at Beltsville, Md., but the poultry feeder should make substitutions to adapt them to local conditions and prices:

Ration No. 1.

Mash:	Pounds.	Scratch mixture:	Pounds.
Corn meal_____	16	Cracked corn_____	2
Meat scrap_____	6½	Wheat _____	1
Bran_____	1	Oats _____	1
Middlings _____	1		

Ration No. 2.

Mash:	Pounds.	Scratch mixture:	Pounds.
Corn meal or barley meal	2	Cracked corn_____	1
Bran_____	1	Wheat _____	1
Middlings _____	1	Oats _____	1
Meat or fish scrap_____	1		

FEEDING THE BREEDING FLOCK.

The breeding flock which is maintained to produce fertile eggs that will hatch into vigorous, healthy chicks should be fed entirely differently from the hens kept for market-egg production.

Very little highly stimulating feed, such as meat scrap, should be given. The hens should not be forced.

The hens should be made to exercise for their feed by feeding the scratch mixture in a deep litter.

An abundance of green feed should be supplied.

Breeding stock should be outdoors every good day throughout the year, the yards or run to be kept in green crops as much as possible.

Vigorous males should be kept with the flock and care taken to see that they get plenty of feed. Following is a good ration for the breeding flock.

Mash :	Pounds.	Scratch mixture :	Pounds.
Bran-----	1	Cracked corn-----	3
Middlings-----	1	Oats-----	2
Corn meal-----	3	Wheat-----	1
Meat scrap-----	1½		
Ground oats-----	1		
Rolled oats-----	1		
Linseed meal-----	½		

FEEDING SITTING HENS.

Feed for sitting hens should consist mostly of whole grains, such as corn and wheat. Green feeds and meat tend to make them desire to quit sitting and begin laying.

FEEDING YOUNG CHICKS.

The chicks should not be fed until they are 48 hours old. Then the first feed should consist of hard-boiled eggs mixed with stale bread crumbs or rolled oats, or a mash of 2 parts rolled oats, 1 part bran, 1 part middlings by weight, mixed with milk or with boiled eggs. These feeds are good for the first three or four days, and should be fed four or five times daily.

Then gradually substitute daily, for two feeds, a mixture of equal parts finely cracked wheat, cracked corn, and "pin-head" oatmeal or hulled oats.

A commercial baby-chick scratch feed and chick mash may be fed to advantage in place of the home-mixed feeds when only a few chicks are raised.

Milk in some form is very beneficial for small chickens and should be added to the ration if possible.

When the chicks are from 10 days to 2 weeks old, feed a growing mash of 1 part by weight of rolled oats, 2 parts bran, 1 part corn meal, 1 part middlings, and one-half part meat scrap.

When the chickens are 8 to 10 weeks old add 1 part ground oats to the mash, increasing the meat scrap to 1 part, the corn meal to 2 parts, and decreasing the bran to 1 part.

The chick feed can be stopped as soon as the chicks will eat whole wheat and cracked corn.

Green feed must be supplied in some form and chicks will grow best on open grass range. If the birds are confined in small yards, green feed should be supplied.

Fresh, cool water and chick-size grit should always be kept before young chickens.

FEEDING FATTENING CHICKENS.

Chickens to be fattened should receive soft feed that can be quickly and easily digested. They should be fed two or three times a day at regular intervals. The following are two good mixtures:

Mixture No. 1:	Pounds.	Mixture No. 2:	Pounds.
Finely ground corn	12	Finely ground oats	15
Wheat bran	4	Finely ground corn	15
Wheat middlings	4	Low-grade flour	2
Meat scrap	1	Bran	1

Mixed with buttermilk.

WATER FOR POULTRY.

Plenty of fresh water should always be accessible to poultry. It should not be exposed to the sun in summer nor allowed to freeze in winter. A flock of 50 hens in laying condition will require from 4 to 6 quarts of water a day, supplied preferably in several containers.

GRIT FOR POULTRY.

Grit is essential to the health of fowls and also to economy in feeding. A box of grit should be kept in every pen or yard.

LIME FOR LAYING HENS.

Laying hens should be supplied crushed oyster shells, clamshells, old mortar, or other sources of lime for the shells of eggs.

SELF-FEEDERS FOR POULTRY FEEDING.

Self-feeders save labor in feeding poultry, and furnish a good method for feeding dry mash, grit, and oyster shells.

An open, square box about 8 inches deep makes the best mash hopper. This should have a wire screen of 2-inch mesh as a follower laid on top of the mash.

PART III. HANDY INFORMATION AND REFERENCE TABLES.

COMMON FEEDS AND THEIR SUBSTITUTES.

The following table shows feeds that may be substituted for some of the most common feeds without greatly affecting the ration:

Feed.	Feeds that may be substituted, quantities depending on relative feeding value.
Whole milk.....	For older animals skim milk supplemented with ground grains. Mature animals may be given buttermilk and whey. The dam's milk, or cow's milk properly modified, is best for very young animals.
Corn.....	Barley, kafir, milo, sorghum, oats, buckwheat, rice, or similar feeds rich in carbohydrates and fats.
Oats.....	Bran, coarse middlings, dried distillers' grains, or feeds having similar physical and nutritive qualities.
Wheat bran.....	Ground oats, other bran, dried distillers' grains, coarse middlings, alfalfa meal, or feeds having similar nutritive and physical qualities.
Linseed meal.....	Peanut meal, gluten feed, copra meal, cottonseed meal (for some animals), velvet-bean meal, or similar feeds high in protein and mineral matter.
Cottonseed meal...	Cottonseed cake, linseed meal, peanut meal, gluten feed, copra meal, velvet-bean meal, sorghum meal, or similar feeds high in protein and mineral matter.
Tankage.....	Fish meal, shrimp bran, meat scrap, or similar feeds high in protein and mineral matter.
Corn silage.....	Sorghum silage, other silage, pasture, wet beet pulp, roots, and green-forage crops, or similar succulent feeds.
Pasture.....	Silage, wet beet pulp, roots, or forage crops are good supplements. (There is no practical substitute for pasture in most sections if economy is considered.)
Clover hay.....	Other legume hays, such as alfalfa, lespedeza, peanut, soybean, cowpea, or velvet-bean hay.
Timothy hay.....	Other grass hays, mixed hays, oats straw, or similar roughages.
Corn stover.....	Other stovers, grass hays, oats straw, or similar roughages.
Oat straw.....	Corn stover, other stovers, barley straw and other straws, cottonseed hulls, and similar feeds.

WEIGHTS AND MEASURES OF COMMON FEEDS.

In calculating rations it is usually necessary to use weights rather than measures. However, it is often handier for the farmer to measure his concentrates. The following table makes this possible:

Weight, in pounds per quart (dry measure) and per bushel.

Feed.	Weight of 1 quart (approx- imate to $\frac{1}{4}$ pound).	Approx- imate weight of 1 bushel.
	Pounds.	Pounds.
Alfalfa feed.....	$\frac{3}{4}$	25
Barley.....	$1\frac{1}{2}$	48
Beet pulp (dried).....	$\frac{1}{2}$	19
Brewers' grains (dried).....	$\frac{1}{2}$	19
Buckwheat.....	$1\frac{1}{2}$	50
Buckwheat bran.....	1	29
Charcoal.....	$\frac{1}{2}$	20
Corn, husked, ear.....	-----	70
Corn, cracked.....	$1\frac{1}{2}$	50
Corn, shelled.....	$1\frac{3}{4}$	56
Corn meal.....	$1\frac{1}{2}$	50
Corn-and-cob meal.....	$1\frac{1}{2}$	45
Cottonseed meal.....	$1\frac{1}{2}$	48
Cowpeas.....	2	60
Distillers' grains (dried).....	$\frac{1}{2}$	19
Fish meal.....	1	35
Gluten feed.....	$1\frac{1}{4}$	42
Linseed meal (old process).....	1	29
Linseed meal (new process).....	1	35
Meat scrap.....	$1\frac{1}{4}$	42
Molasses feed.....	$\frac{3}{4}$	26
Oats.....	1	32
Oats, ground.....	$\frac{3}{4}$	22
Oat middlings.....	$1\frac{1}{2}$	48
Peanut meal.....	1	29
Rice bran.....	$\frac{3}{4}$	26
Rye.....	$1\frac{3}{4}$	56
Soybeans.....	$1\frac{3}{4}$	60
Tankage.....	$1\frac{1}{4}$	42
Velvet beans, shelled.....	$1\frac{1}{2}$	60
Wheat.....	2	60
Wheat bran.....	$\frac{1}{2}$	19
Wheat middlings, standard.....	$\frac{3}{4}$	26
Wheat screenings.....	1	32

SOME FEEDING TERMS EXPLAINED.

Concentrates.—Feeds, such as grains, cottonseed meal, and tankage, which are rich and concentrated and supply a large amount of feed per unit weight.

Roughages.—Feeds, such as hay, straws, roots, and silage, which are coarse and bulky in nature.

Legumes.—Plants, such as clover, alfalfa, cowpeas, soybeans, etc., which have nodules on their roots containing bacteria,

which can take nitrogen from the air. Legumes are generally richer in protein and minerals than other roughages.

Nutrients.—Substances in feeds which nourish animals.

Protein.—The only nutrient which can produce growth and make repairs in the animal's body. Lean meat, skim milk, wheat bran, cottonseed meal, and tankage are some of the feeds which contain relatively large amounts of protein.

Carbohydrates and fat.—Nutrients which produce fat, heat, and power to do work in the animal's body. Fat is about two and one-fourth times as valuable for these uses as carbohydrates. Feeds containing large amounts of starch and sugar are rich in carbohydrates, while large amounts of fat are contained in oily feeds. Corn is rich in both carbohydrates and fat.

Mineral matter.—Nutrients used principally to build the skeleton, hair, hoof, horn, etc. Legume hays, bran, linseed meal, and skim milk have relatively large amounts of mineral matter.

Vitamins.—Substances found in feeds in very small quantities, which are necessary for growth, reproduction, and protection against diseases, such as scurvy.

Crude fiber.—The coarse, woody part of plants, and one of the carbohydrates much less digestible than the others.

Ration.—The quantity of feed given an animal during one day.

Balanced ration.—A ration which contains the proper proportion of nutrients to nourish properly the animal to which it is fed.

Nutritive ratio, carbohydrate equivalent, and certain other terms are too technical for adequate discussion in this brief handbook. The reader is referred to feeding textbooks and other authorities.

PROTEIN IN LIVESTOCK FEEDS.

Since most American farm-grown feeds contain an excess of fat and carbohydrates and a scarcity of protein, the percentage of protein in feeds that have to be purchased is one of the best measures of the value of such feeds. The following tables classify some of the most common roughages and concentrates according to their approximate protein content and will be a good guide in buying feeds. These tables will also be of help in planning rations where it is necessary to know the approximate amount of protein contained in the various components of the ration.

Digestible protein content of common roughages.

LOW-PROTEIN ROUGHAGES.

- About 1 per cent :
 - Rye straw.
 - Wheat straw.
 - Oat straw.
- About 3 per cent :
 - Corn fodder.
 - Corn stover.
 - Canada blue-grass hay.
 - Clover straw.
 - Cowpea straw.
 - Soybean straw.
 - Meadow-fescue hay.
 - Rye hay.
 - Timothy hay.
- About 5 per cent :
 - Buckwheat straw.
 - Clover and timothy hay.
 - Barley hay.
 - Kafir fodder.
 - Kentucky blue-grass hay.
 - Millet hay.
 - Mixed-grass hay.
 - Oat hay.
 - Orchard-grass hay.
 - Prairie hay.
 - Redtop hay.
 - Sweet-corn fodder.
 - Wheat hay.

HIGH-PROTEIN ROUGHAGES.

- About 7 per cent :
 - Alsike-clover hay.
 - Emmer hay.
 - Native western blue-grass hay.
 - Peanut vine (without nuts).
 - Red-clover hay.
 - Vetch and oats hay.
- About 9 per cent :
 - Alfalfa hay (first cutting).
 - Crimson-clover hay.
 - Lespedeza hay.
 - Peas and oats hay.
- About 11 per cent :
 - Alfalfa hay (second cutting).
 - Alfalfa meal.
 - Red-clover hay (before bloom).
 - Sweet-clover hay.
 - Soybean hay.
 - Vetch hay (common vetch).
- About 13 per cent :
 - Cowpea hay.
 - Canadian field-pea hay.
 - Velvet-bean hay.
- About 15 per cent :
 - Alfalfa hay (before bloom).
 - Alfalfa leaves.
 - Hairy-vetch hay.

Digestible protein content of common concentrates.

- About 5 per cent :
 - Beet pulp (dry).
 - Buttermilk.
 - Corn-and-cob meal.
 - Corn meal.
 - Hominy feed.
 - Skim milk.

- About 10 per cent :
 - Alfalfa meal.
 - Barley.
 - Kafir grain.
 - Molasses feeds.
 - Oats.
 - Rice polish.

Digestible protein content of common concentrates—Continued.

About 10 per cent—Continued.

Rye.

Sorghums, ground.

About 15 per cent:

Oatmeal.

Red-dog flour.

Sunflower seed (with hulls).

Velvet-bean meal (pods included).

Wheat bran.

Wheat middlings.

About 20 per cent:

Brewers' grains (dry).

Coconut meal.

Cowpeas.

Distillers' grains (dried).

Gluten feed.

Fresh ground bone.

Peanut meal (with hulls).

About 25 per cent:

Buckwheat middlings.

Gluten meal (low grade).

About 30 per cent:

Gluten meal (high grade).

Linseed meal.

Soybeans.

About 35 per cent:

Cottonseed meal.

Meat-and-bone meal.

About 40 per cent:

Peanut meal (without hulls).

Soybean-cake meal (fat extracted).

About 45 per cent:

Peanut cake (from hulled nuts).

Above 45 per cent:

Tankage contains from 40 to 60 per cent protein, depending upon the method of manufacture. The guaranty tag states the protein content of tankage.

Fish meal has about the same protein content as tankage.

Dried blood may contain as much as 80 per cent protein.

SIZE AND CAPACITY OF SILOS.

The diameter of the silo should depend on the amount of silage to be fed daily, while the height should be governed by the length of the feeding season. Hence, before constructing a silo the farmer should know approximately (1) the number of stock he intends to feed, (2) the amount of silage to be fed daily, and (3) the number of days silage is to be fed.

In general, the height of the silo should not be less than twice nor more than three times the diameter. The diameter should be small enough to remove enough silage from the entire surface each day to prevent spoiling. When feeding in winter it is safe to remove as little as 2 inches daily; but for summer feeding 3 inches should be removed daily. The tables below show the capacities of silos of different sizes and the proper diameter of the silo for herds of different sizes for winter and summer feeding:

*Number of animals that can be fed from silos of various sizes
(on basis of 40 pounds of silage per cubic foot).*

Inside diameter of silo.	Number of animals that may be fed, allowing—			
	40 pounds per head.	30 pounds per head.	20 pounds per head.	15 pounds per head.
WINTER FEEDING TO A DEPTH OF 2 INCHES DAILY.				
<i>Feet.</i>				
10	13	17	26	35
11	16	21	31	42
12	19	25	37	50
13	22	29	44	59
14	25	34	51	68
15	29	39	59	78
16	33	44	67	89
17	38	50	75	101
18	42	56	85	113
20	52	70	104	139
SUMMER FEEDING TO A DEPTH OF 3 INCHES DAILY.				
10	19	26	39	52
11	23	31	47	63
12	28	37	56	75
13	33	44	66	88
14	38	51	77	102
15	44	59	88	118
16	50	67	100	134

Capacity of silos for various depths of silage.

Depth of silage (after settling 2 days).	Capacity of silo having an inside diameter of—									
	10 feet.	11 feet.	12 feet.	13 feet.	14 feet.	15 feet.	16 feet.	17 feet.	18 feet.	20 feet.
<i>Feet.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
24	34									
26	38	46	55							
28	42	51	61	71	83					
30	47	56	67	79	91	105				
32		62	74	86	100	115	131			
34			80	94	109	126	143	161		
36			87	102	119	136	155	175	196	
38				110	128	147	167	189	212	261
40					138	158	180	203	228	281
42						170	193	218	245	302
44							207	234	262	323
46								250	280	345
48										368

NOTE.—These figures taken in part from King's Physics of Agriculture.

TO DETERMINE QUANTITY OF HAY IN A RICK.

Generally, 512 cubic feet of hay in a stack or mow weigh 1 ton. To determine with reasonable accuracy the number of tons of hay in a rick of average shape, multiply the over—that is, the distance from the ground on one side to the ground on the other—by the width, then the length, and then by 0.37.

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FARMERS' BULLETINS RELATING TO THE FEEDING OF LIVESTOCK.

Following are some selected publications dealing with various problems of livestock feeding in much more detail than in this handbook:

- 578. Making and Feeding Silage.
- 655. Cottonseed Meal for Feeding Beef Cattle.
- 724. Feeding Grain Sorghums to Livestock.
- 743. The Feeding of Dairy Cows.
- 840. Farm Sheep Raising for Beginners.
- 873. Utilization of Farm Wastes in Feeding Livestock.
- 906. The Self-Feeder for Hogs.
- 920. Milk Goats.
- 951. Hog Pastures for Southern States.
- 972. How to Use Sorghum Grain.
- 1030. Feeding Horses.
- 1067. Feeding Hens for Egg Production.
- 1073. Growing Beef on the Farm.
- 1095. Beet-Top Silage and Its By-Products.
- 1133. Feeding Garbage to Hogs.
- 1147. Milo, a Valuable Grain Crop.
- 1158. Growing and Utilizing Sorghum for Forage.
- 1179. Feeding Cottonseed Products to Livestock.
- 1181. Raising Sheep on Temporary Pastures.
- 1218. Beef Production in the Corn Belt.
- 1229. Utilization of Alfalfa.
- 1336. Feeding and Management of Dairy Cows and Young Dairy Stock.

REPORTS OF EXPERIMENTAL WORK.

Experimental work is continually being conducted and the results are reported in Department Bulletins, which are more detailed than Farmers' Bulletins. A list of such reports for various classes of experiments will be furnished on request.

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A PAGE OF CAUTIONS.

THINGS LIVESTOCK FEEDERS SHOULD NOT DO.

Don't withhold feed from young, growing animals when they want it.

Don't feed a ration containing corn alone to any class of stock.

Don't allow your breeding animals to become so thin that you have to apologize for their condition.

Don't feed milk from tuberculous cattle to your animals.

Don't feed carcasses of animals that have died of disease to any of your stock or chickens.

Don't feed more grain mixture or concentrate than the animal will clean up quickly, except when forcing fattening animals.

Don't allow pregnant breeding animals to become too fat.

Don't use pastures too early in the spring and don't graze pastures too closely.

Don't let animals go thirsty.

Don't forget to salt all animals regularly.

Don't feed animals of different ages and sizes in the same pen or lot.

Don't let strong and aggressive animals rob the weak of the proper amount of feed.

Don't turn cattle or sheep on luxuriant clover when the dew is on.

Don't put fresh feed in dirty or sour troughs.

Don't allow dairy cows and laying hens to become fat.

Don't waste your surplus feeds.

Don't feed frozen, moldy, or spoiled silage.

Don't change an animal's ration abruptly.

Don't feed animals poorly because they're not producing; feed them and give them a chance.

Don't keep scrub and inferior stock; they are wasteful of feed.

TEN POINTS IN BETTER FEEDING.

"MAKE EVERY POUND OF FEED YIELD A PROFIT."

1. GROWING ANIMALS make best use of feed—keep them growing.
 2. WEANING TIME is a critical period; start feeding before weaning.
 3. BALANCED RATIONS supply animals' needs with least feed.
 4. WATER and SALT should always be accessible.
 5. LEGUMES, PASTURES, and SUCCULENT FEEDS aid production and profit.
 6. FEED LIBERALLY for large production; mere maintenance yields no profit.
 7. BREEDING ANIMALS should be kept thrifty, not overfat.
 8. GOOD FEEDING EQUIPMENT prevents waste of feed and labor.
 9. PARASITES, EXPOSURE, and OVERCROWDING retard growth and waste feed.
 10. FEED COSTS are important; not all balanced rations yield equal profit.
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"GOOD BREEDING HELPS FEED BRING BEST RESULTS."

If you want help with a specific feeding problem, obtain a "Feeding-Problem Sheet."

Ask your State Agricultural College, your county extension agent, or address Bureau of Animal Industry, United States Department of Agriculture, Washington, D. C.